

CLAIMS

- 1 1. A centrifugally-cast tube comprising:
2 a tubular body made from a creep-resistant alloy,
3 the body having an exterior surface and an interior surface,
4 the interior surface including a plurality of bosses and a plurality of
5 grooves, and
6 the plurality of bosses and grooves being mechanically machined into the
7 interior surface.
- 1 2. The tube of claim 1, wherein the plurality of bosses and grooves are defined by a
2 plurality of intersecting concave and convex radii.
- 1 3. The tube of claim 1, wherein the plurality of bosses and grooves are formed by a
2 broaching process.
- 1 4. The tube of claim 1, wherein the interior surface is resistant to carburization and
2 metal dusting.
- 1 5. The tube of claim 1, wherein the surface roughness and dimensional accuracy of
2 the interior surface is superior to that of a centrifugally-cast tube wherein the plurality of bosses
3 and grooves are formed by an electrochemical machining process.

1 6. The tube of claim 1, wherein the plurality of bosses and grooves form a profile
2 that is at least 5% longer than a circumference of a smallest circle that encompasses the entire
3 resulting profile.

1 7. The tube of claim 1, wherein the interior surface has a surface roughness of less
2 than 125 RMS (CLA).

1 8. A method of improving a centrifugally-cast tube comprising:
2 passing a first cutting tool having a plurality of first cutting inserts through a bore
3 of the tube so as to mechanically remove a first quantity of material from
4 the bore and to commence the formation of a plurality of grooves and
5 bosses;
6 passing a second cutting tool having a plurality of second cutting inserts through
7 the bore so as to mechanically remove a second quantity of material from
8 the bore and to continue the formation of the plurality of grooves and
9 bosses, the plurality of second cutting inserts having dimensions different
10 than corresponding dimensions of the plurality of first cutting inserts; and
11 continuing to pass additional cutting tools having a plurality of additional cutting
12 inserts through the bore so as to continue to mechanically remove
13 additional quantities of material from the bore until a desired profile of
14 grooves and bosses is achieved, each set of additional cutting tools having

15 dimensions different than corresponding dimensions of the cutting inserts
16 employed in the immediately preceding pass.

1 9. The method of claim 8, wherein the dimensions of each subsequent set of cutting
2 tools are larger than the corresponding dimensions of the cutting tools employed in the
3 immediately preceding pass.

1 10. The method of claim 9, wherein the dimensions incrementally increase at a rate of
2 between 0.05 mm and 0.1 mm per pass.

1 11. A method of improving a centrifugally-cast tube comprising:
2 forming a plurality of grooves and bosses in an interior surface of the tube by
3 mechanically deforming the interior surface.

1 12. The method of claim 11, wherein the plurality of grooves and bosses are gradually
2 formed by passing a series of cutting tools having incrementally-differing dimensions over the
3 interior surface.

1 13. An apparatus for improving a centrifugally-cast tube comprising:
2 a first and a second guide adapted to hold the tube;
3 a telescoping shaft adapted to pass longitudinally through a bore of the tube; and

4 at least one cutting tool attached to the shaft and including a plurality of cutting
5 inserts, the cutting tool being adapted to mechanically form a profile of
6 grooves and bosses within the bore of the tube.

1 14. The apparatus of claim 13, wherein the cutting inserts are indexable.

1 15. The apparatus of claim 13, wherein the cutting inserts are provided with concave
2 cutting surfaces.

1 16. The apparatus of claim 13, wherein the cutting inserts are provided with convex
2 cutting surfaces.

1 17. The apparatus of claim 13, wherein the at least one cutting tool includes a
2 plurality of cutting tools attached to the shaft, and further including at least one spacer collar
3 disposed about the shaft and adapted to maintain the cutting tools in spaced relationship.

1 18. The apparatus of claim 13, further including means for lubricating the apparatus.

1 19. The apparatus of claim 13, further including means for attaching the at least one
2 cutting tool to the shaft.

1 20. The apparatus of claim 13, further including means for attaching the at least one
2 cutting tool to the shaft.

1 21. The apparatus of claim 13, further including at least one centering guide.